Small Business Innovation Research/Small Business Tech Transfer

Automated Radiation Measurements for Aerospace Safety - Dual Monitor (ARMAS-DM), Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The *Automated Radiation Measurements for Aerospace Safety – Dual Monitor* (ARMAS-DM) project addresses these science and engineering goals:1) demonstrate a real-time COTS-based technology for regional ionizing-radiation monitoring at high altitudes and high latitudes using two simultaneous balloons; 2) enable a game-changing technology for global aviation safety; 3) aid human space exploration by helping specify the radiation environment consistently from the surface to Low Earth Orbit (LEO); 4) provide data for assimilation into the NASA NAIRAS radiation model now being applied to the International Space Station (ISS) radiation safety protocol; and 5) enable a better understanding of the dynamic and variable radiation environment due to all sources for altitudes transitioning into space by measuring both total dose and energy. We combine proven radiation detection using up to five sensors (two total ionizing dose micro dosimeter (ARMAS), one tissue equivalent proportional counter linear energy transfer spectra detector (ATED), possibly one advanced neutron spectrometer (ANS), and one Silicon linear energy transfer dosimeter (Liulin). We will combine them with Iridium data downlink and ground data-processing server facilities for two long-duration balloons flights to demonstrate long-term, regional monitoring that enables aviation radiation risk management. We will directly monitor the changing radiation environment due to space weather, i.e., Galactic Cosmic Rays (GCRs) and trapped energetic electron precipitation (EEP), which are the main sources of radiation from commercial aviation to LEO altitudes. Detection of a rare solar proton event (SPE) would be serendipitous, however, we do not expect to see SPEs and success does not require their detection. We will measure absorbed dose (silicon) and derive effective dose rates (human tissue).

Anticipated Benefits

Our work will help mitigate the negative effect of radiation on human physical and behavioral health, helping optimize human performance in space. A long duration measurement, validation, and characterization of the dynamic radiation dose up to 23 km will provide a system-level method for operationally monitoring that environment through data assimilation into the NAIRAS system. A successful flight will provide new dose rate data for an infrequently studied altitude range in the stratosphere.

Astronauts, high-altitude pilots, frequent commercial aviation flyers, and eventually commercial space travelers, as well as the operational air/space traffic management infrastructure supporting them, will be able to obtain, in real-time and for a trivial incremental cost, their relevant radiation environment. This system can be integrated into the global aviation radiation management environment as envisioned by other U.S. Government agencies including the FAA. It will include forecasts.

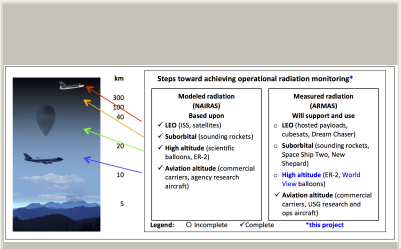

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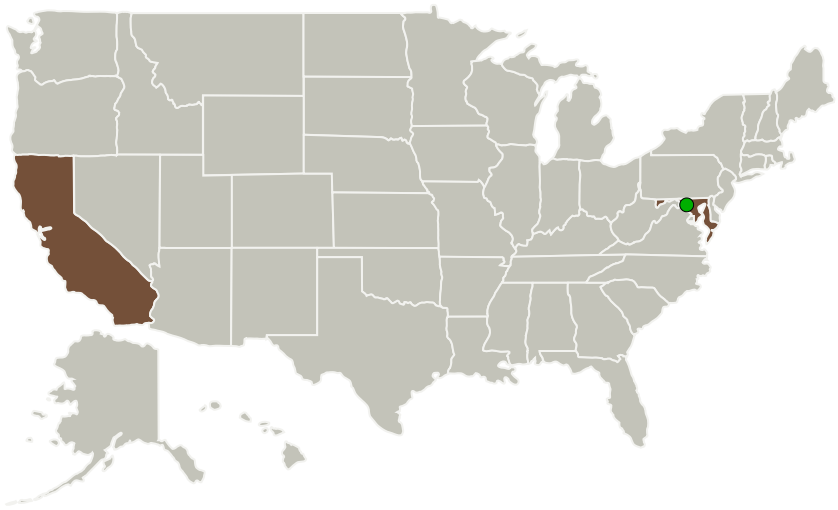
Table of Contents

Automated Radiation Measurements for Aerospace Safety - Dual Monitor (ARMAS-DM), Phase I

Completed Technology Project (2018 - 2019)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Space Environment Technologies, LLC	Lead Organization	Industry	Pacific Palisades, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140943)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Space Environment Technologies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William K Tobiska

Co-Investigator:

W. Kent Tobiska

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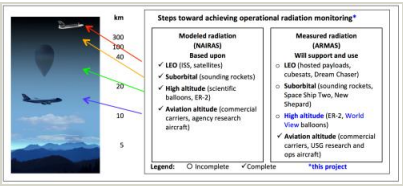
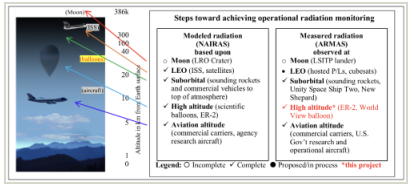
Images



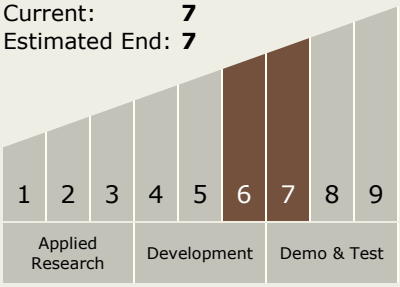
Briefing Chart Image
Automated Radiation Measurements for Aerospace Safety - Dual Monitor (ARMAS-DM), Phase I
(https://techport.nasa.gov/image/133293)



Final Summary Chart Image
Automated Radiation Measurements for Aerospace Safety - Dual Monitor (ARMAS-DM), Phase I
(https://techport.nasa.gov/image/130324)

Technology Maturity (TRL)

Start: **6**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.5 Radiation
    - TX06.5.1 Radiation Transport and Risk Modeling

Target Destinations

Earth, The Moon, Mars